

New Hampshire Volunteer Lake Assessment Program

2003 Interim Report for Millen Pond Washington



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Water Division
Watershed Management Bureau
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OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **MILLEN POND, WASHINGTON**, the program coordinators have made the following observations and recommendations:

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 mg/m³.**

The current year data (the top graph) show that the chlorophyll-a concentration **increased** from July to August. The chlorophyll-a concentration on both sampling events was ***much less than*** the state mean.

Overall, visual inspection of the historical data (the bottom graph) shows a ***slightly decreasing*** (*meaning slightly improving*) chlorophyll-a trend since monitoring began in 1995. However, if the elevated 1995 mean is excluded, the mean annual concentration has ***remained approximately the same***, and ***much less than*** the state mean, since 1996. We hope this trend continues!

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Algal concentrations may increase with an increase in nonpoint sources of phosphorus loading from the watershed, or in-

lake sources of phosphorus loading (such as phosphorus releases from the sediments). Therefore, it is extremely important for volunteer monitors to continually educate residents about how activities within the watershed can affect phosphorus loading and lake/pond quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the lake/pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

The current year data (the top graph) show that the in-lake transparency ***decreased greatly*** from July to August. It is worthy to note that the Secchi disk depth on the July sampling event was the ***deepest*** reading that has been measured since monitoring began! On the August sampling event, it was breezy and the water surface had ripples, which may have made it difficult to view the Secchi disk.

It is also interesting to note that as the chlorophyll concentration *increased* from July to August, the transparency *decreased*. We typically expect this *inverse* relationship in lakes. As the amount of algal cells in the water column *increases*, the ability for light (and consequently, the ability to view the Secchi disk in the water column) often *decreases*.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a ***slightly increasing*** trend for in-lake transparency, meaning that the transparency has ***slightly improved*** since monitoring began in 1995.

As discussed previously, after 10 consecutive years of sample collection, we will conduct a statistical analysis of the historical data to determine long-term trends for lake quality.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located

immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **remained stable** July to August. The phosphorus concentration on both sampling events was **much less than** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration **decreased** from July to August. The phosphorus concentration on both sampling events was **less than** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion and the hypolimnion show a **decreasing** total phosphorus trend, which means that the concentration has **slightly improved** in since monitoring began. We hope this trend continues!

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands.

TABLE INTERPRETATION**➤ Table 2: Phytoplankton**

Table 2 (Appendix B) lists the current and historical phytoplankton species observed in the lake/pond. The dominant phytoplankton species observed this year were ***Chrysosphaerella* (a golden-brown algae), *Rhizosolenia* (a diatom), and *Dinobryon* (a golden-brown algae).**

Phytoplankton populations undergo a natural succession during the growing season (Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire’s less productive lakes and ponds.

➤ Table 4: pH

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire’s lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the “Chemical Monitoring Parameters” section of this report.

The mean pH at the deep spot this season ranged from **5.82** in the hypolimnion to **5.97** in the epilimnion, which means that the water is ***slightly acidic***. When organic matter near the lake bottom is decomposed, acidic by-products are produced, which likely explains the lower pH (meaning higher acidity) in the hypolimnion.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH.

➤ Table 5: Acid Neutralizing Capacity

Table 5 (Appendix B) presents the current year and historical epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire’s lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are “highly

sensitive” to acidic inputs. For a more detailed explanation, please refer to the “Chemical Monitoring Parameters” section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) continued to remain ***much less than*** the state mean. Specifically, the mean ANC this season was **0.60 mg/L**, which indicates that the lake/pond is ***critically sensitive*** to acidic inputs (such as acid precipitation). This is the lowest ANC value yet observed at Millen Pond.

➤ **Table 6: Conductivity**

Table 6 (Appendix B) presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The mean conductivity value for New Hampshire’s lakes and ponds is **62.1 uMhos/cm**. For a more detailed explanation, please refer to the “Chemical Monitoring Parameters” section of this report.

The conductivity in the lake/pond is relatively ***low*** and ***less than*** the state mean. However, the conductivity has ***gradually increased*** in the lake/pond and inlets since monitoring began. Typically, sources of increased conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake/pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

➤ **Table 8: Total Phosphorus**

Table 8 (Appendix B) presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae’s ability to grow and reproduce. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The Inlet and Outlet were sampled for phosphorus this season, and the concentration in each sample was ***relatively low*** (10 ug/L or less). We hope this continues!

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling

organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen concentration was **relatively high** at all depths sampled at the deep spot of the lake/pond. As stratified lakes/ponds age, oxygen becomes **depleted** in the hypolimnion (lower layer) by the process of decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological oxidation of organic matter (i.e.; biological organisms using oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake/pond where the water meets the sediment.

➤ **Table 11: Turbidity**

Table 11 (Appendix B) lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The turbidity in the **deep spot** and **Inlet** samples was **relatively low** this season.

The turbidity in the **Outlet** sample on the July and August sampling events was **slightly elevated** (1.4 and 1.8 NTUs respectively). This suggests that the stream bottom may have been disturbed while sampling, that runoff from impervious surfaces is entering the lake, or that erosion is occurring in this portion of the watershed.

When the stream bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting samples in the inlets, please be sure to sample where there the stream is flowing and where the stream is deep enough to collect a “clean” sample.

If you suspect that stormwater runoff or erosion is occurring in this portion of the watershed, we recommend that your monitoring group conduct stream surveys and storm event sampling. This additional sampling may allow us to determine what is causing the elevated levels of turbidity.

For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report “Special Topic Article”, or contact the VLAP Coordinator.

➤ **Table 12: Bacteria (*E.coli*)**

Table 12 lists the current year data for bacteria (*E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism

because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **MAY** be present. If sewage is present in the water, potentially harmful disease-causing organisms **MAY** also be present.

The **1 SE Shore** and **2 SW Shore** locations were sampled for *E.coli* this season. The *E.coli* concentration was fewer than 10 counts per 100 mL of sample, which is **relatively low**.

If you are particularly concerned about bacteria levels at these locations, we recommend that your monitoring group conduct *E.coli* testing next season on a weekend during heavy beach use or after a rain event. Since *E.coli* die quickly in cool pond waters, testing is most accurate and most representative of the health risk to bathers when the source (humans, animals, or waterfowl) is present.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your lake/pond, the biologist conducted a “Sampling Procedures Assessment Audit” for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor’s Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors are not following the proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group performed **very well** while collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures. The biologist did identify one aspect regarding sample collection that the volunteer monitors could improve upon.

- **Chlorophyll-a Sampling:** When collecting the chlorophyll-a sample using the **composite method**, please make sure to collect one Kemmerer bottle full of water at each meter from the starting point up to 1 meter from the surface. Specifically, in lakes with one or two thermal layers, begin at 2/3 the total depth and collect water at every meter up to the surface. In lakes with three layers, start at the

middle of the middle layer (metalimnion) and collect water at every meter up to the surface.

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an **excellent** job when collecting samples and submitting them to the laboratory this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

USEFUL RESOURCES

Acid Deposition Impacting New Hampshire's Ecosystems, ARD-32, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/ard/ard-32.htm.

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, NHDES-WD 97-8, NHDES Booklet, (603) 271-3503.

Camp Road Maintenance Manual: A Guide for Landowners. Kennebec Soil and Water Conservation District, 1992, (207) 287-3901.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-1.htm

Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or www.des.state.nh.us/factsheets/wqe/wqe-7.htm

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, WD-BB-9, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-9.htm.

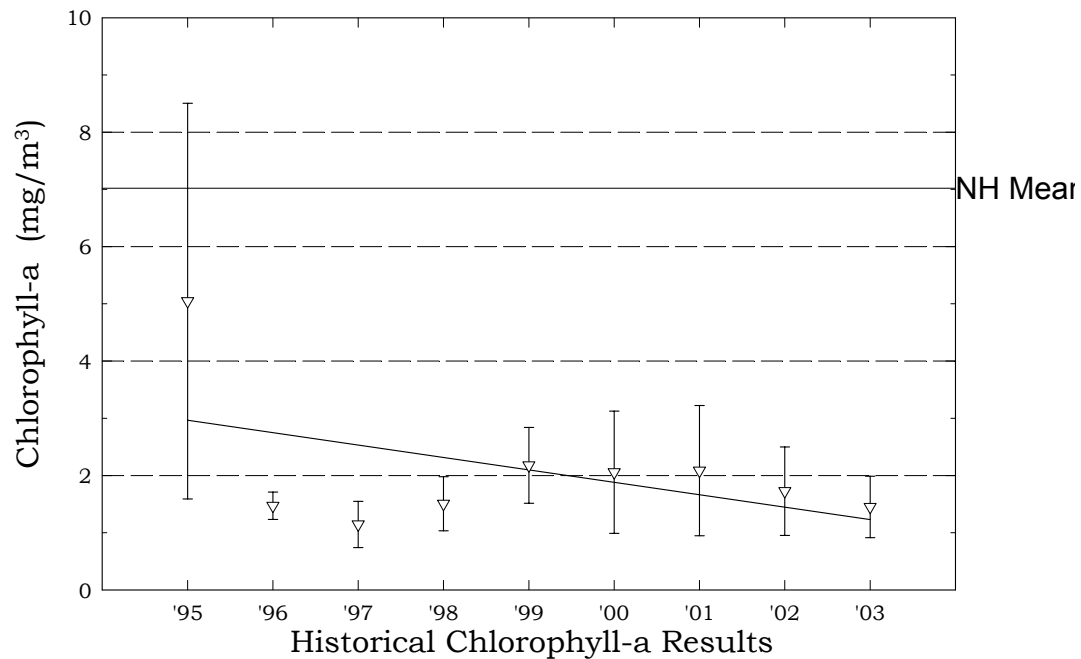
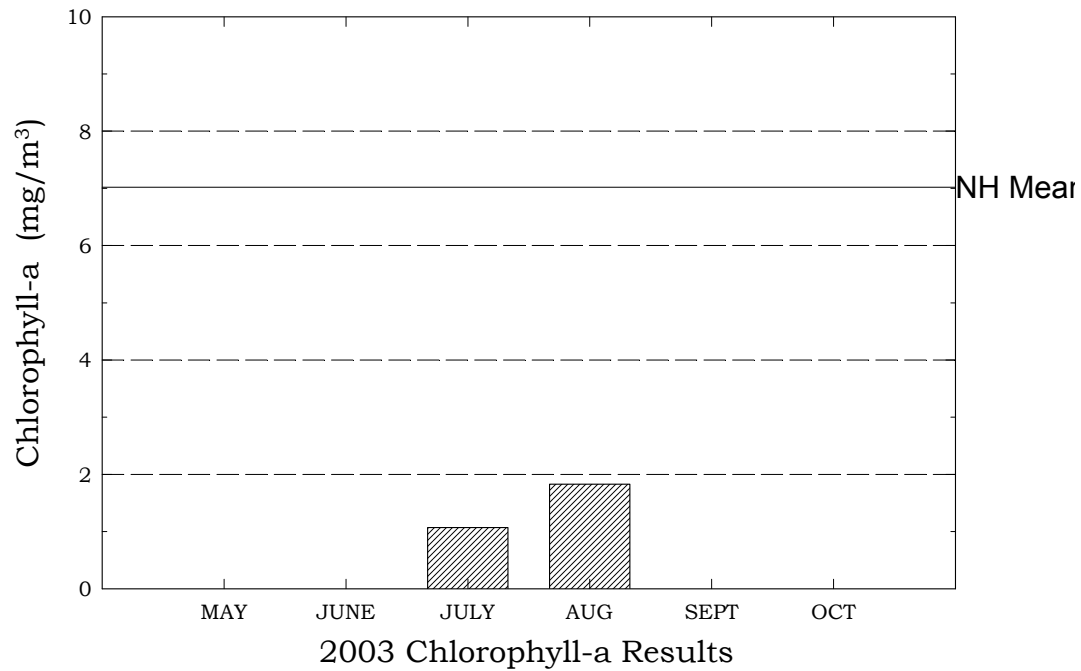
Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgmt/DOCS/BMP_DOCS/Goosedraft.pdf.

APPENDIX A

GRAPHS

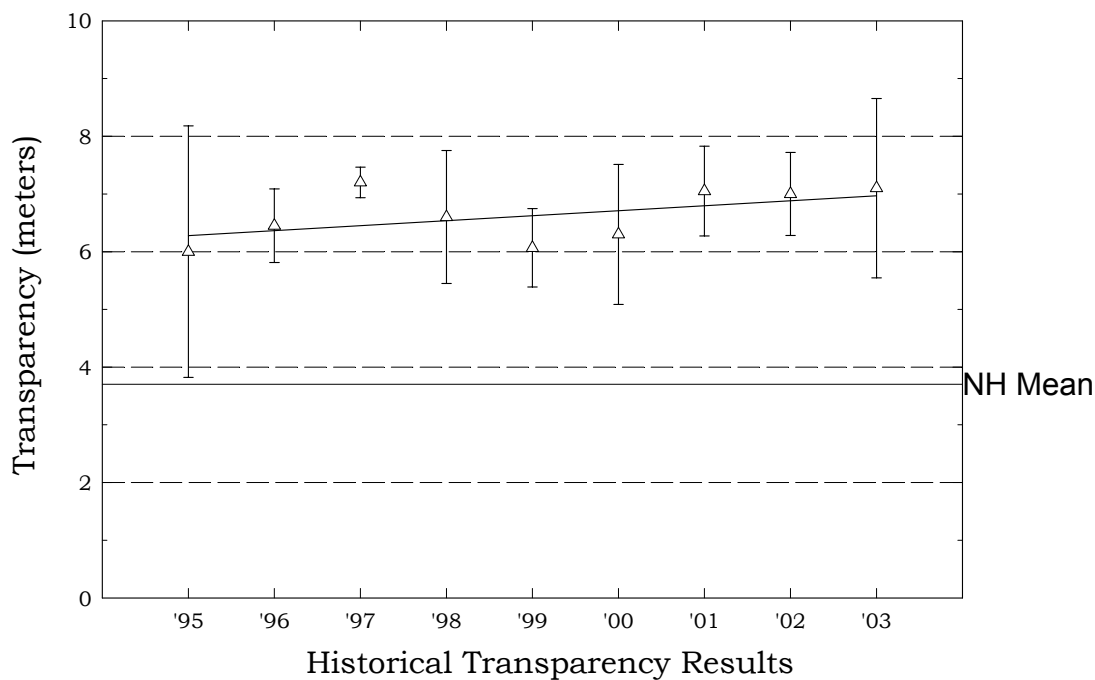
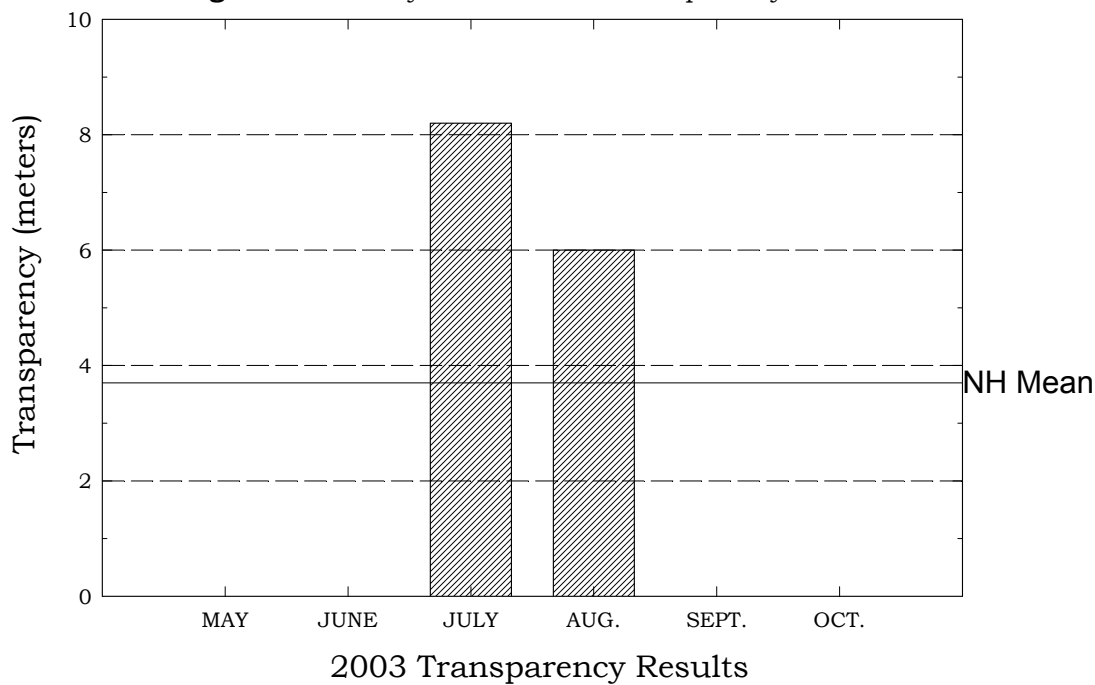
Millen Pond, Washington

Figure 1. Monthly and Historical Chlorophyll-a Results



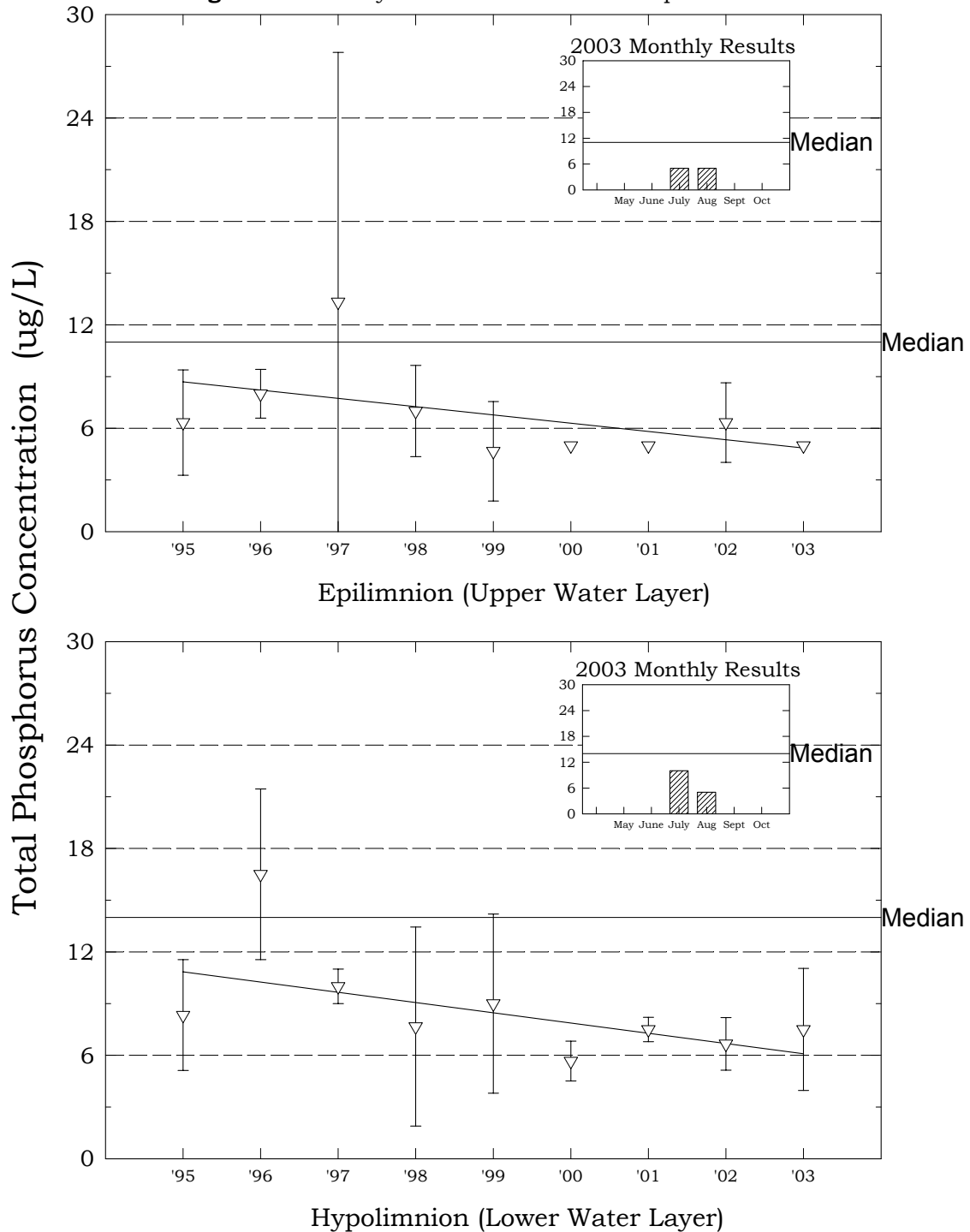
Millen Pond, Washington

Figure 2. Monthly and Historical Transparency Results



Millen Pond, Washington

Figure 3. Monthly and Historical Total Phosphorus Data.



OBSERVATIONS AND RECOMMENDATIONS

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